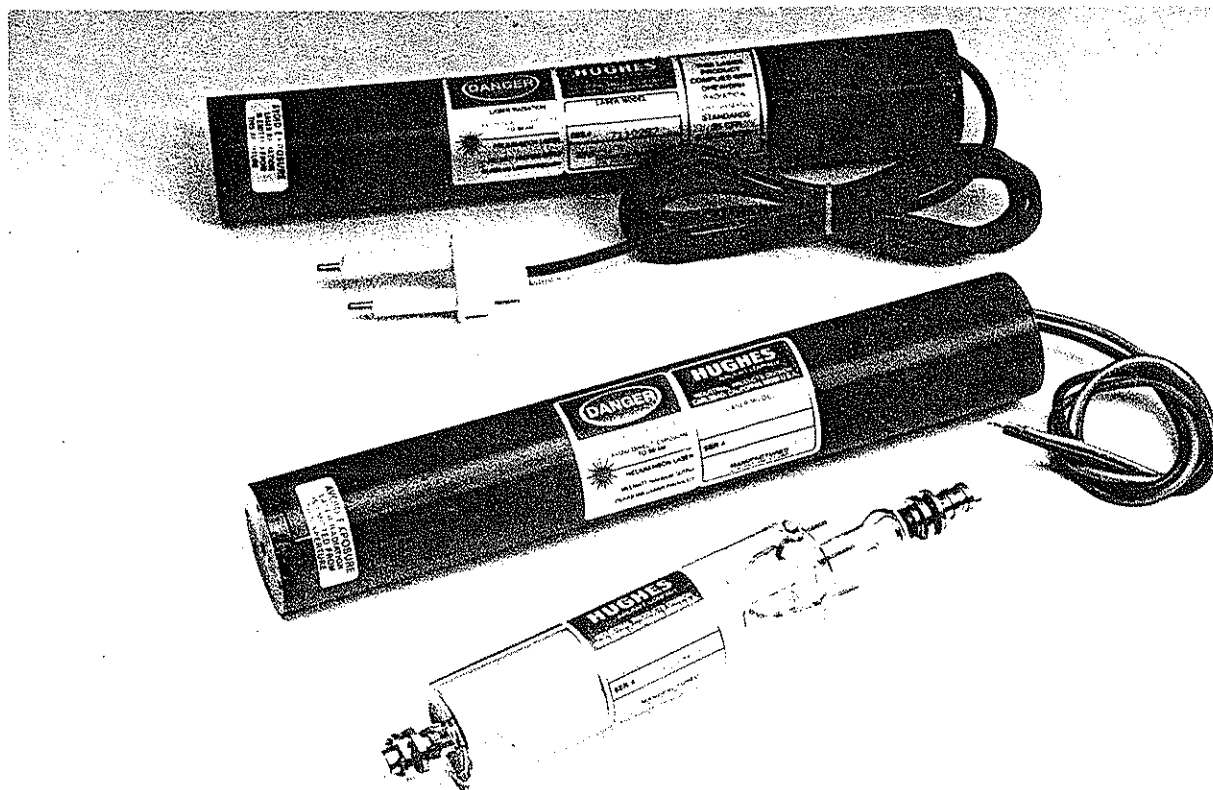




HUGHES LF Series 1 and 2 mW Helium-Neon Lasers

PROVEN OEM PERFORMANCE

- Hughes hard-seal construction
- Rugged coaxial internal mirror construction
- Specially developed hard glass

OEMs depend on the LF Series' stable performance, long trouble-free operation and high reliability.

OEMs depend on Hughes world reputation for leading the way in lasers.

Hughes LF Series lasers are backed by a 12-month warranty (18 months available for qualified OEMs). Specifications are subject to change without notice.

LASERS SPECIFICATIONS

LASER HEAD MODEL NO.			LASER PLASMA TUBE MODEL NO.	
3221H	Flying Leads	3222H	3121H	3122H
3221H-C	High Voltage Conn.	3222H-C	3121H-P	3122H-P
3221H-P	Polarized/Flying Leads	3222H-P		
3221H-PC	Polarized/High Voltage Conn.	3222H-PC		

• Minimum output power TEM ₀₀ at 632.8 nm (mW)	1.0	2.0	1.0	2.0
• Beam diameter 1/2 (mm)	0.64	0.64	0.64	0.64
• Beam divergence (mrad)	1.3	1.3	1.3	1.3
• Longitudinal mode spacing (c/2L)(MHz)	685	685	685	685
• Operating voltage (Vdc ± 100)	1740	1740	1350	1350
• Recommended series anode ballast (kΩ)	Included in head	Included in head	60 to 75	60 to 75
• Connection with power source	Flying leads or high voltage connector Alden No. 8102M	Flying leads or high voltage connector Alden No. 8102M	—	—

COMMON SPECIFICATIONS

- Amplitude noise (30 Hz-10 MHz) < 1% rms
Note: Ripple is generally higher with dc power supply
- Long term drift ± 5% (in any 8 hr. period following 15 min. warm-up)
- Starting voltage < 10.0 kVdc
- Optimum operating current 6.5 ± 0.2 mA
- Static alignment (head) centered to outer cylinder to ≤ 0.010 in, parallel to outer cylinder to ≤ 1 mrad
- Angular drift < 0.2 mrad from cold start at 25°C < 0.03 mrad after 15-minute warm-up
- Polarization
("P" models only)

Linear, 500:1
extinction ratio

COMMON ENVIRONMENTAL SPECIFICATIONS

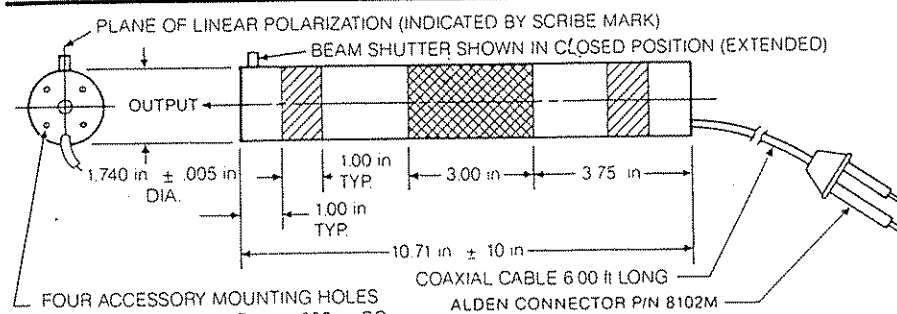
Temperature
Altitude
Relative humidity
without condensation
Shock

OPERATING

-20°C to 50°C
0-10,000 ft.
0-100%

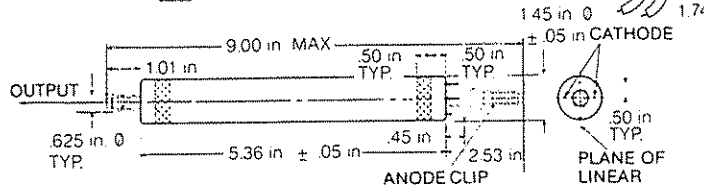
NON-OPERATING

-40°C to 80°C
0-70,000 ft.
0-100%
50 g for 1 ms
15 g for 11 ms

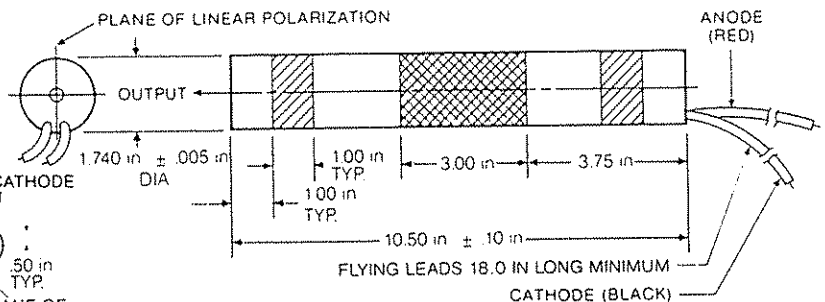


1 and 2 mW MODELS WITH H.V. CABLE AND CONNECTOR AND BEAM SHUTTER

RECOMMENDED MOUNTING AREAS
ALTERNATE MOUNTING AREA



INTERNAL MIRROR PLASMA TUBE

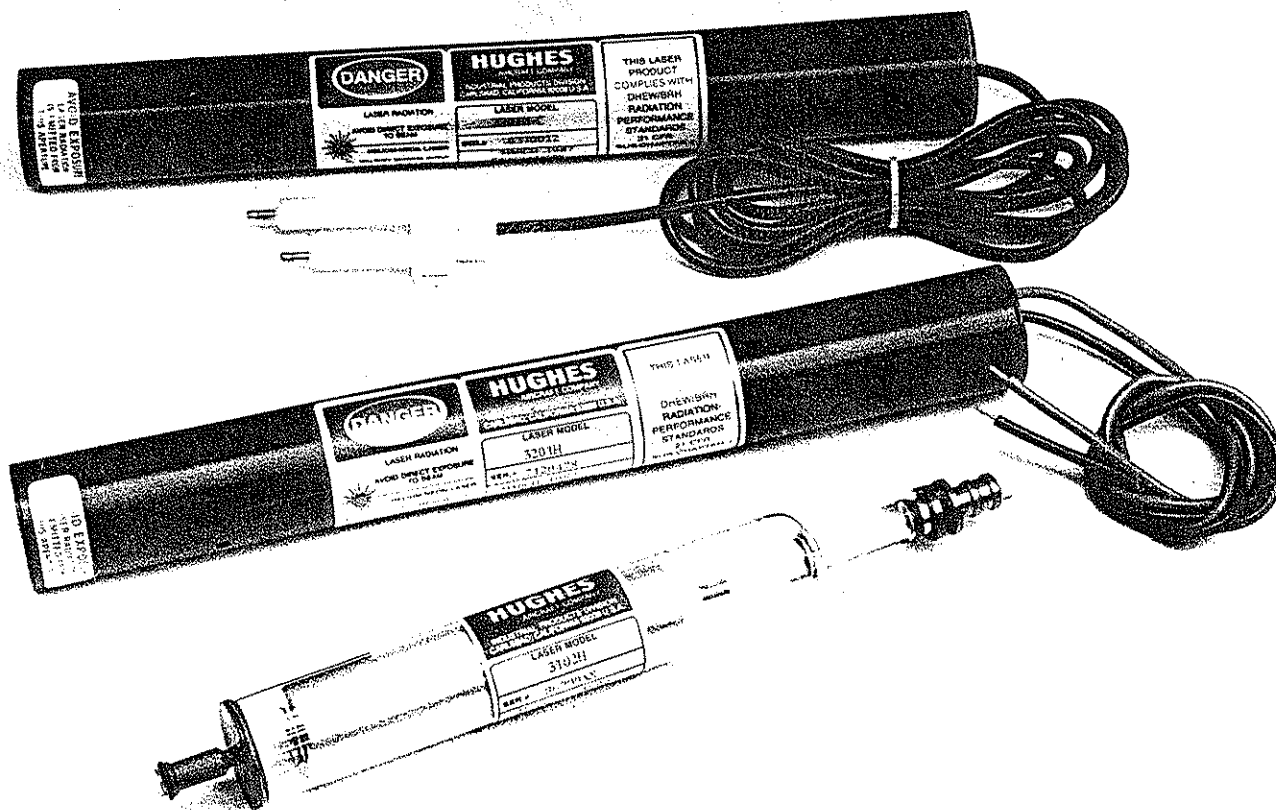


1 and 2 mW MODELS WITH FLYING LEADS

Specifications subject to change without notice

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6155 El Camino Real, Carlsbad, CA 92009 Tel: (619) 931-3587 TWX: 910-322-1393

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HUGHES LC Series 1 and 2 mW Helium-Neon Lasers

PROVEN OEM PERFORMANCE

The LC Series are compact lasers featuring hard seal construction and a patented cathode design. This gives OEM users the best performance and lifetimes possible.

Hughes LC Series lasers are backed by a 12-month warranty (18 months available to qualified OEMs). Specifications are subject to change without notice.

LASERS SPECIFICATIONS

LASER HEAD MODEL NO.			LASER PLASMA TUBE MODEL NO.	
3201H	Flying Leads	3203H	3101H	3102H
3201-C	High Voltage Conn.	3203H-C	3101H-P	3102H-P
3201H-P	Polarized/Flying Leads	3203H-P		
3201H-PC	Polarized/High Voltage Conn.	3203H-PC		

• Minimum output power TEM ₀₀ at 632.8 nm (mW)	1.0	Random 2.0 Polarized 1.5	1.0	Random 2.0 Polarized 1.5
• Beam Diameter 1/2 (mm)	0.49	0.49	0.49	0.49
• Beam Divergence (mrad)	1.7	1.7	1.7	1.7
• Longitudinal mode spacing (c/2L)(MHz)	635	635	635	635
• Operating voltage (Vdc ± 100)	1770	1770	1430	1430
• Required series anode ballast (kΩ) (Ballast location 3 inches from anode.)	Included in head	Included in head	75	75
• Connection with power source	Flying leads or high voltage connector Alden No. 8102M	Flying leads or high voltage connector Alden No. 8102M	—	—

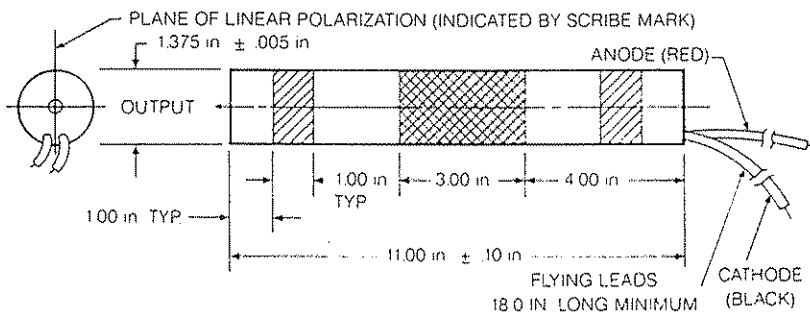
COMMON SPECIFICATIONS

- Amplitude noise (30 Hz-10 MHz) < 1% rms
Note: Ripple is generally higher with dc power supply
- Long term drive ± 5% (in any 8 hr. period following 15 min. warm-up)
- Starting voltage < 8 kVdc
- Optimum operating current 4.5 ± 0.2 mA
- Static alignment (head) centered to outer cylinder to ≤ 0.010 in., parallel to outer cylinder to ≤ 1 mrad
- Angular drift
< 0.2 mrad from cold start at 25°C
< 0.03 mrad after 15-minute warm-up
- Polarization Liner, 500:1
("P" models only) extinction ratio

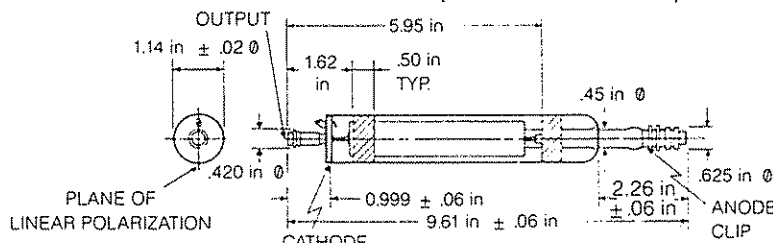
Specifications subject to change without notice.

COMMON ENVIRONMENTAL SPECIFICATIONS

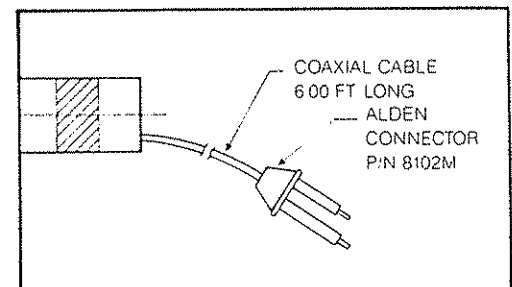
	OPERATING	NON-OPERATING
Temperature	-20°C to 50°C	-40°C to 80°C
Altitude	0-10,000 ft	0-70,000 ft
Relative humidity without condensation	0-100%	0-100%
Shock		50 g for 1 ms 15 g for 11 ms



MODELS WITH FLYING LEADS (H AND H-P MODELS)



INTERNAL MIRROR PLASMA TUBE

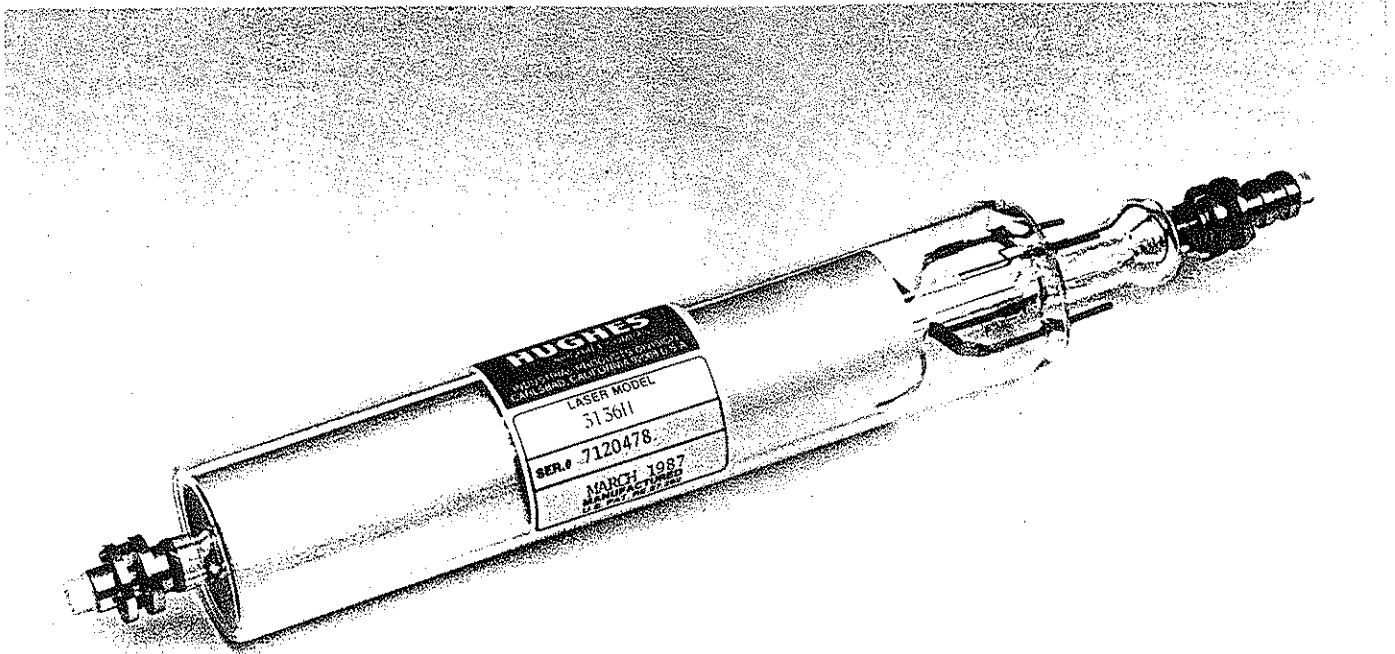


WITH H.V. CONNECTOR (H-C and H-PC MODELS)
(All other dimension same as H and H-P models)

- RECOMMENDED MOUNTING AREAS
- ALTERNATE MOUNTING AREA

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HUGHES LF Series Model 3136H 2 mW Helium-Neon Laser

PROVEN OEM PERFORMANCE

- Hughes hard-seal construction
- Rugged coaxial internal mirror construction
- Specially developed hard glass
- Hard-seal replacement for the 80-2T

OEMs depend on the LF Series' stable performance, long trouble-free operation and high reliability.

Hughes LF Series lasers are backed by a 12-month warranty (18 months for qualified OEMs).

LASER SPECIFICATIONS

INTERNAL MIRROR PLASMA TUBE MODEL NO. 3136H

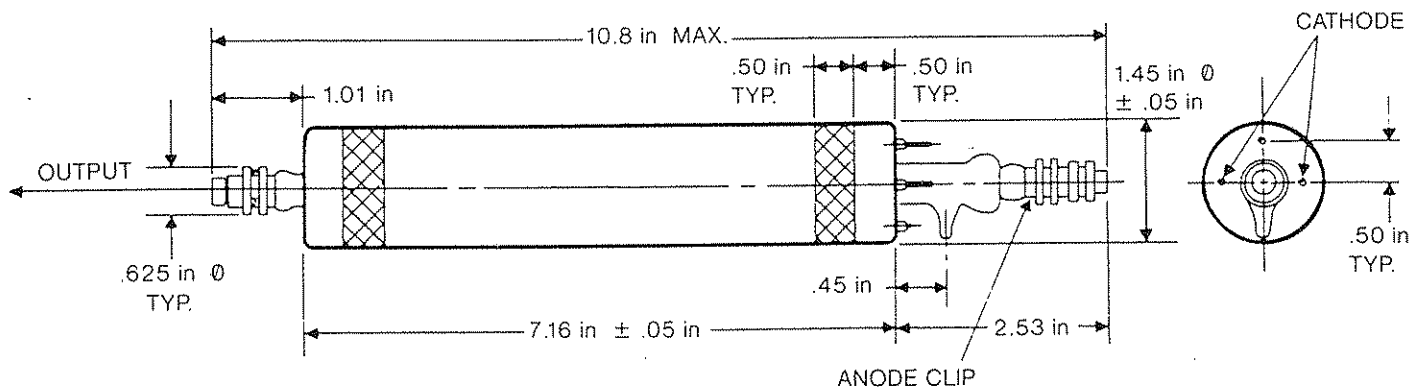
• Minimum output power TEM ₀₀ at 632.8 nm (mW)	2.0
• Beam diameter 1/2 (mm)	.83
• Beam divergence (mrad)	1.0
• Longitudinal mode spacing (c/2L) (MHz)	575
• Operating voltage (Vdc ± 100)	1450
• Recommended series anode ballast (kΩ)	60 to 75

COMMON SPECIFICATIONS

- Amplitude noise (30 Hz-10 MHz) < 1% rms
Note: Ripple is generally higher with dc power supply
- Long term drive ± 5% (in any 8-hour period following 15-minute warm-up)
- Starting voltage < 10.0 kVdc
- Optimum operating current 6.0 ± 0.2 mA
- Angular drive < 0.2 mrad from cold start at 25°C < 0.03 mrad after 15-minute warm-up

COMMON ENVIRONMENTAL SPECIFICATIONS

	OPERATING	NON-OPERATING
Temperature	-20°C to 50°C	-40°C to 80°C
Altitude	0-10,000 ft.	0-70,000 ft.
Relative humidity without condensation	0-100%	0-100%
Shock		50 g for 1 ms 15 g for 11 ms



RECOMMENDED MOUNTING AREAS

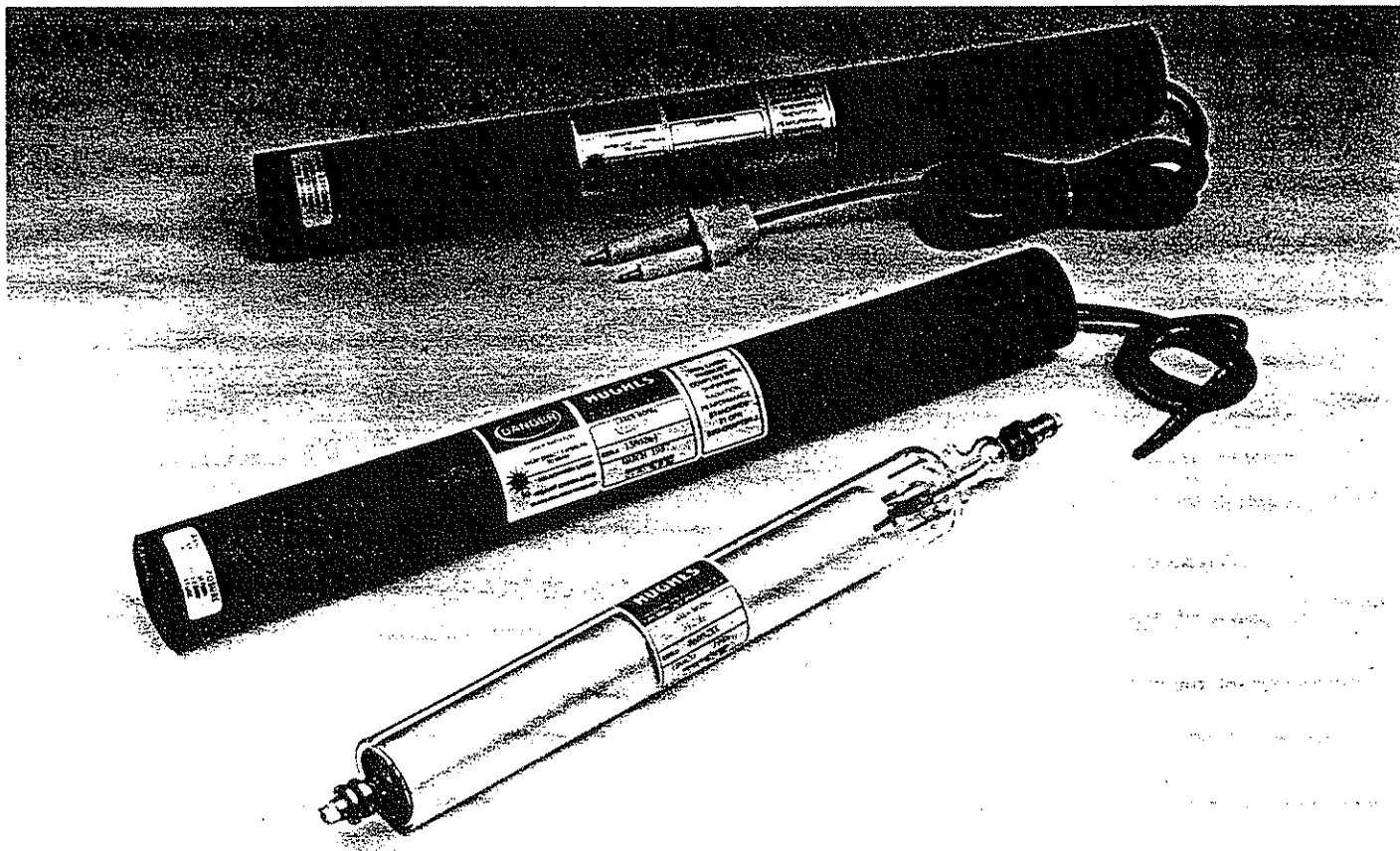
CENTER FOR DEVICES AND RADIOLOGICAL HEALTH

Laser models on this data sheet are sold only on an OEM or export basis and have not been certified relative to CDRH performance standard 21CFR1040. It is the user's responsibility to certify product compliance where applicable.

Specifications are subject to change without notice

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HUGHES LF Series 4 and 5 mW Helium-Neon Lasers

PROVEN OEM PERFORMANCE

- Hughes hard-seal construction
- Rugged coaxial internal mirror construction
- Specially developed hard glass

OEMs depend on the LF Series' stable performance, long trouble-free operation and high reliability.

OEMs depend on Hughes world reputation for leading the way in lasers.

Hughes LF Series lasers are backed by a 12-month warranty (18 months available for qualified OEMs). Specifications are subject to change without notice.

LASER SPECIFICATIONS

	LASER HEAD MODEL NO.			LASER PLASMA TUBE MODEL NO.	
	3224H	Flying Leads	3225H	3124H	3125H
	3224H-C	High Voltage Conn.	3225H-C	3124H-P	3125H-P
	3224H-P	Polarized/Flying Leads	3225H-P		
	3224H-PC	Polarized/High Voltage Conn.	3225H-PC		

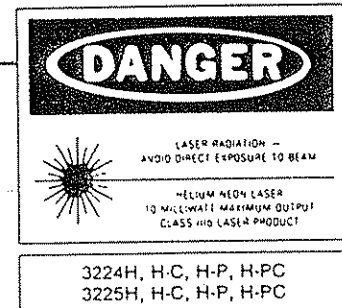
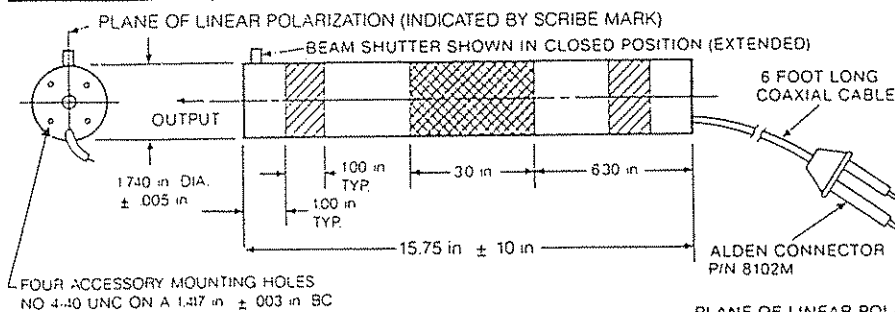
• Minimum output power TEM ₀₀ at 632.8 nm (mW)	4.0	5.0	4.0	5.0
• Beam diameter 1/2 (mm)	0.83	0.83	0.83	0.83
• Beam divergence (mrad)	1.0	1.0	1.0	1.0
• Longitudinal mode spacing (c/2L)(MHz)	435	435	435	435
• Operating voltage (Vdc ± 100)	2300	2300	1910	1910
• Recommended series anode ballast (kΩ)	Included in head	Included in head	60 to 75	60 to 75
• Connection with power source	Flying leads or high voltage connector Alden No. 8102M	Flying leads or high voltage connector Alden No. 8102M	—	—

COMMON SPECIFICATIONS

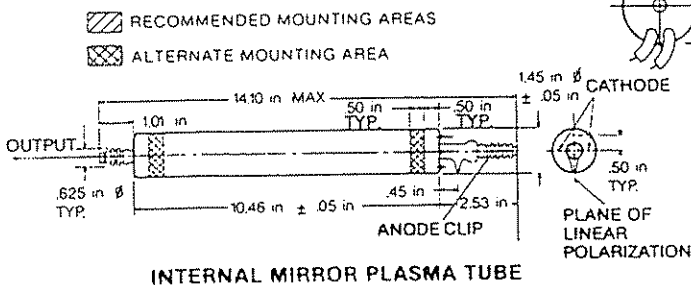
- Amplitude noise (30 Hz-10 MHz) < 1% rms
Note: Ripple is generally higher with dc power supply
- Long term drift ± 5% (in any 8 hr. period following 15 min. warm-up)
- Starting voltage ≤ 10.0 kVdc
- Optimum operating current 6.5 ± 0.2 mA
- Angular drift < 0.3 mrad from cold start at 25°C. < 0.04 mrad after 15-minute warm-up
- Static alignment (head) centered to outer cylinder to ≤ 0.010 in. parallel to outer cylinder to ≤ 1 mrad
- Polarization
(“P” models only) Linear, 500:1 extinction ratio

COMMON ENVIRONMENTAL SPECIFICATIONS

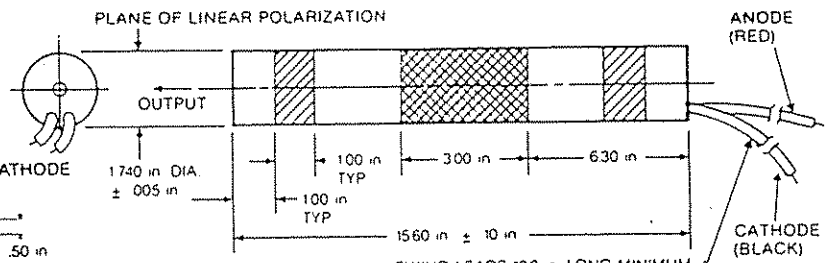
	OPERATING	NON-OPERATING
Temperature	-20°C to 50°C	-40°C to 80°C
Altitude	0-10,000 ft	0-70,000 ft
Relative humidity without condensation	0-100%	0-100%
Shock		50 g for 1 ms 15 g for 11 ms



4 & 5 mW MODELS WITH HIGH VOLTAGE CONNECTOR AND BEAM SHUTTER



INTERNAL MIRROR PLASMA TUBE

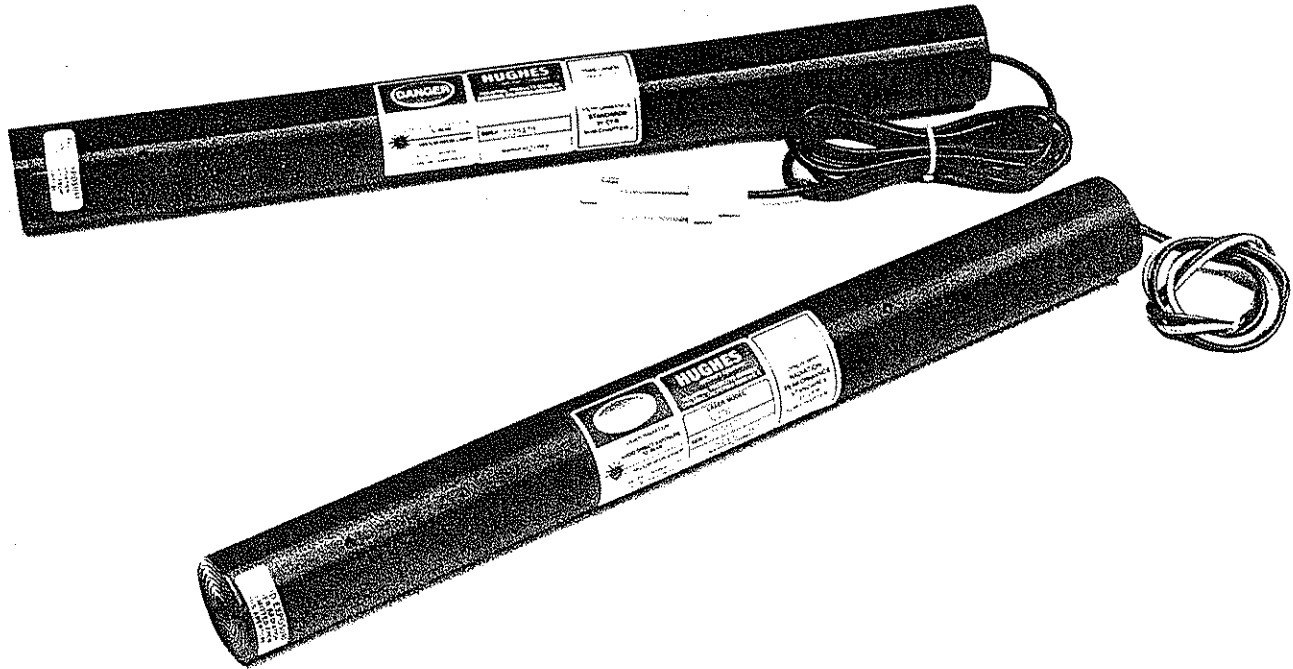


4 & 5 mW MODELS WITH FLYING LEADS

Specifications subject to change without notice

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HUGHES AIRCRAFT SYSTEMS INTERNATIONAL
Frederich Hendriklaan 22 - 2012 SZ Haarlem, the Netherlands - Phone: (23) 292-155 - Telex: 15733



HUGHES LF Series 7.0 mW Helium-Neon Lasers

PROVEN OEM PERFORMANCE

- Hughes hard-seal construction
- Rugged coaxial internal mirror construction
- Specially developed hard glass

OEMs depend on the LF Series' stable performance, long trouble-free operation and high reliability.

OEMs depend on Hughes world reputation for leading the way in lasers.

Hughes LF Series lasers are backed by a 12-month warranty (18 months available for qualified OEMs). Specifications are subject to change without notice.

LASER SPECIFICATIONS

LASER HEAD MODEL NO.

High Voltage Conn.	3227H-C
Flying Leads	3227H
Polarized/Flying Leads	3227H-P
Polarized/High Voltage Conn.	3227H-PC

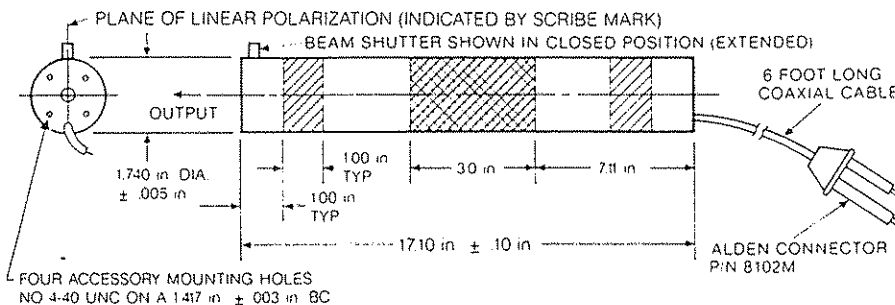
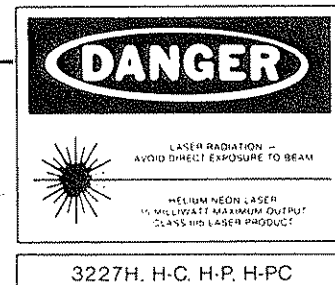
• Minimum output power TEM ₀₀ at 632.8 nm (mW)	7.0
• Beam diameter 1/e ² (mm)	.82 mm
• Beam divergence (mrad)	1.1
• Longitudinal mode spacing (c/2L)(MHz)	410
• Operating voltage (Vdc ± 100)	2600
• Recommended series anode ballast (kΩ)	Included in head
• Connection with power source	High voltage connector Alden No. 8102M

COMMON SPECIFICATIONS

- Amplitude noise (30 Hz-10 Mhz) < 1% rms
Note: Ripple is generally higher with dc power supply
- Long term drift ± 5% (in any 8 hr. period following 15 min. warm-up)
- Starting voltage ≤ 10.0 kVdc
- Optimum operating current 7.0 ± 0.2mA
- Angular drift < 0.3 mrad from cold start at 25°C. < 0.04 mrad after 15-minute warm-up
- Static alignment (head) centered to outer cylinder to ≤ 0.010 in, parallel to outer cylinder to ≤ 1 mrad
- Polarization
("P" models only) Linear, 500:1 extinction ratio

COMMON ENVIRONMENTAL SPECIFICATIONS

	OPERATING	NON-OPERATING
Temperature	-20°C to 50°C	-40°C to 80°C
Altitude	0-10,000 ft	0-70,000 ft
Relative humidity without condensation	0-100%	0-100%
Shock		15 g for 11 ms



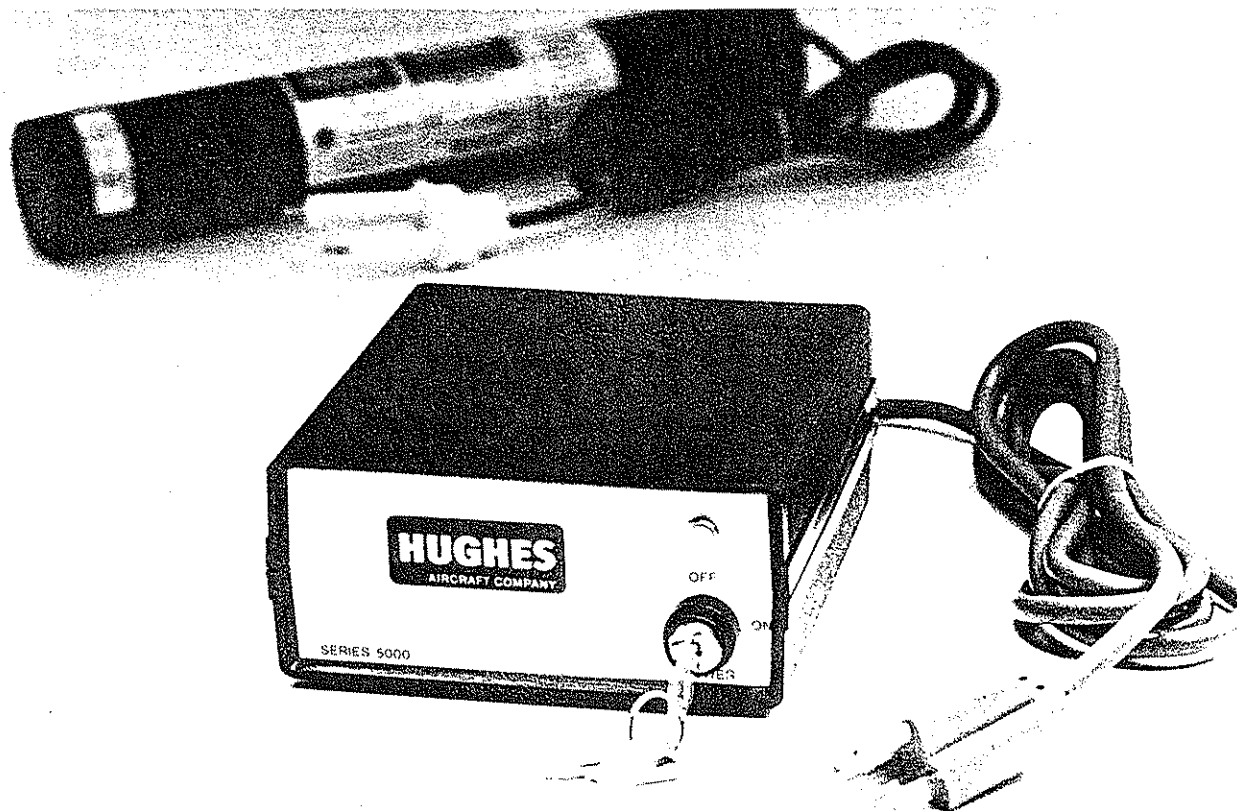
7.0 mW MODELS WITH HIGH VOLTAGE CONNECTOR AND BEAM SHUTTER

- RECOMMENDED MOUNTING AREAS
- ALTERNATE MOUNTING AREA

Specifications are subject to change without notice

HUGHES AIRCRAFT COMPANY • Industrial Products Division
6155 El Camino Real, Carlsbad, CA 92009 • Tel: (619) 931-3587 • TWX: 910-322-1393

HUGHES AIRCRAFT SYSTEMS INTERNATIONAL
Frederik Hendrikslaan 22, 2012 SH Haarlem, The Netherlands • Phone: (23) 292453 • TDX: 41733



HUGHES 5000 Series 115/230 Vac CDRH Certified Helium-Neon Laser Power Supply

**OPERATES 0.5 mW to
7.0 mW LASER HEADS**

- Ultra compact configuration
- Contains all CDRH required accessories for Class II and IIIb laser products
 - key activated switch
 - ignition time delay
 - pilot light emission indicator
 - remote interlock connector

GENERAL DESCRIPTION

The 5000 series power supplies have been designed to provide optimum electrical interface with Hughes 0.5 through 7 mW laser heads. The high power conversion-efficient design, coupled with feedback regulated starting voltage and output current regulation circuits, ensure maximum laser performance

and system reliability. The patented electronic current filtering technique yields a laboratory quality dc output current with an ultra low ripple component. Packaged in a rugged, compact enclosure, the 5000 series power supplies are suitable for both OEM and laboratory applications.

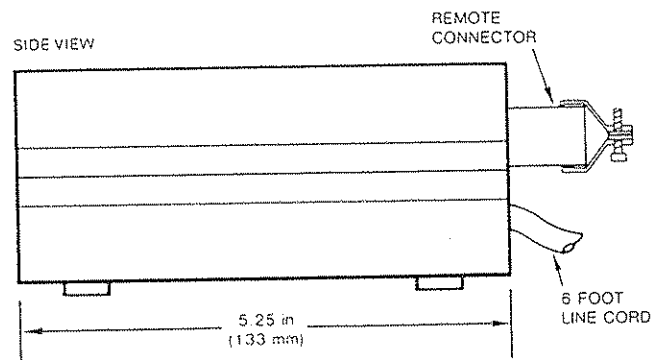
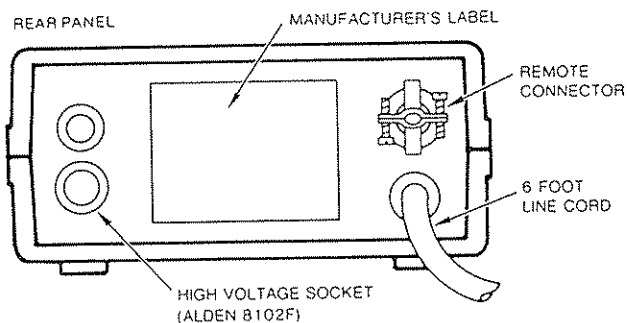
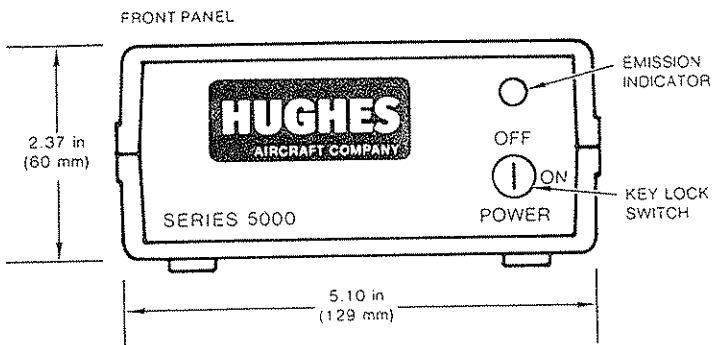
POWER SUPPLY MODELS

	5000	5010	5020	5040
For operation with laser model	3209H-C 3209H-PC	3223H-C 3223H-PC	3221H-C 3221H-PC 3222H-C 3222H-PC 3224H-C 3224H-PC 3225H-C 3225H-PC	3227H-C 3227H-PC
Output start voltage (feedback regulated) (kVdc min)	8	10	10	10
Output sustaining voltage (Vdc)	1550-1750	1550-1750	1630-2450	2600-2800
Laser operating current (mA $\pm$ 0.05)	4.5	7.0	6.5	7.0
Laser beam amplitude ripple (PTP)	<0.5%	<0.5%	<0.5%	<1.0%
(Includes only the laser beam amplitude ripple component attributable to the power supply.)				

COMMON SPECIFICATIONS

- Ignition delay 3.5 s nominal
- Mass 2.3 lb/1.1 kg
- Input power 115 Vac $\pm$ 10% or 230* Vac $\pm$ 10% (50-400 Hz)
- Operating temperature -20°C to +50°C

*To order models for 230 Vac operation, add the letter "F".



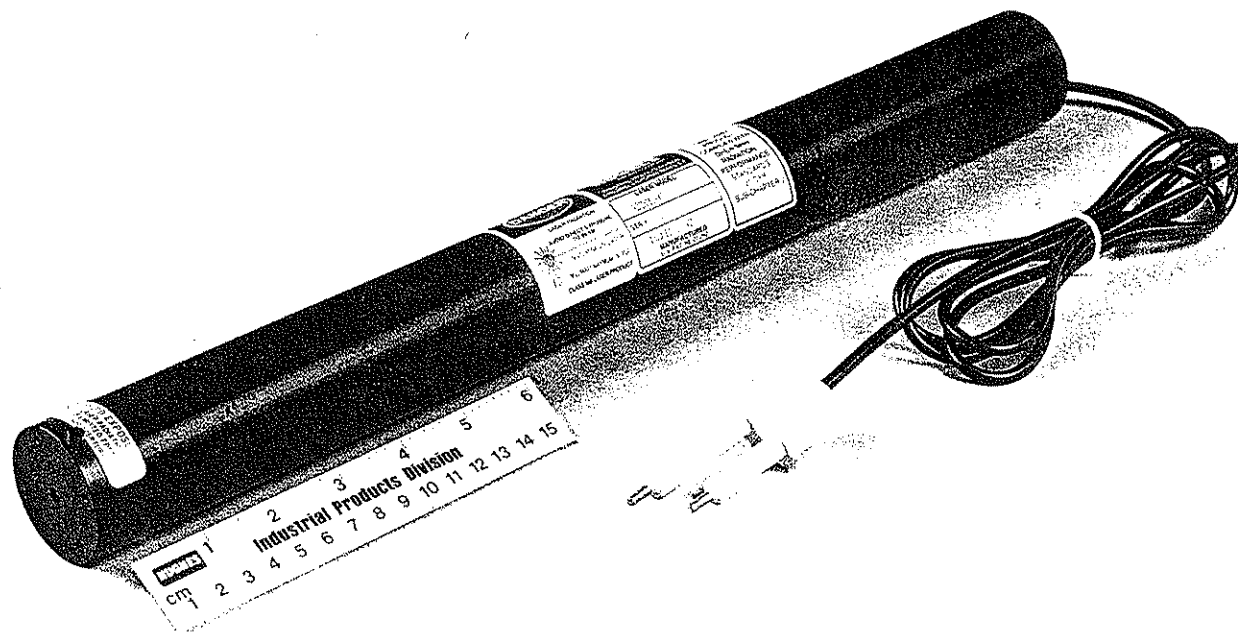
Specifications are subject to change without notice

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6155 El Camino Real, Carlsbad, CA 92009 Tel: (619) 931-3587 TWX: 910-322-1393

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HUGHES

Subsidiary of GM Hughes Electronics



HUGHES LF Series 10.0 mW Helium-Neon Lasers

PROVEN OEM PERFORMANCE

- Hughes hardseal construction
- Rugged coaxial internal mirror construction
- Specially developed hard glass

OEMs depend on the LF Series stable performance, long trouble-free operation and high reliability.

OEMs depend on Hughes' world reputation for leading the way in lasers.

Hughes LF Series lasers are backed by a 6-month warranty. Specifications are subject to change without notice.

LASER SPECIFICATIONS

LASER HEAD	MODEL NO.
High Voltage Connector	3230H-C
Polarized/High Voltage Connector	3230H-PC

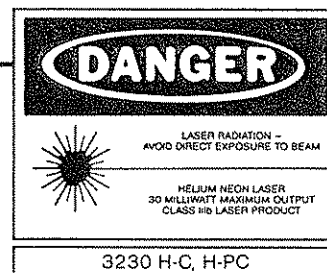
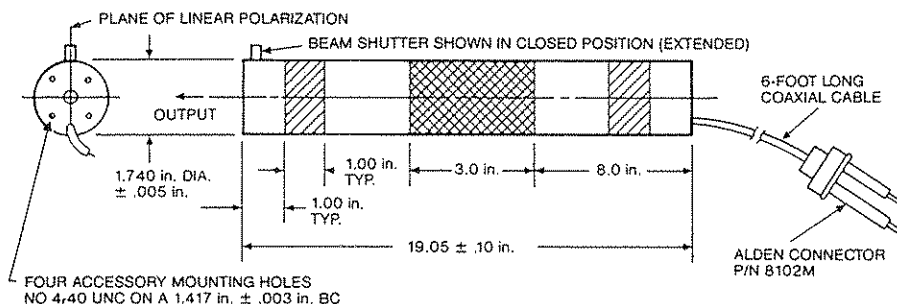
- | | |
|--|---|
| • Minimum output power
TEM ₀₀ at 632.8 nm (mW) | 10.0 |
| • Beam diameter $1/e^2$ (mm) | .68 mm |
| • Beam divergence (mrad) | 1.2 |
| • Longitudinal mode spacing
($c/2L$)(MHz) | 350 |
| • Operating voltage (Vdc $\pm$ 100) | 2800 |
| • Recommended series anode
ballast (k Ω) | Included in head
(60 k Ω) |
| • Connection with power source | High voltage connector
Alden No. 8102M |

COMMON SPECIFICATIONS

- Amplitude noise (30 Hz–10 MHz) < 1% rms
Note: Ripple is generally higher with dc power supply
- Long term drift $\pm 5\%$ (in any 8-hour period following 15-minute warm-up)
- Starting voltage ≤ 10.0 kVdc
- Optimum operating current 7.0 ± 0.2 mA
- Angular drift < 0.3 mrad from cold start at 25°C < 0.04 mrad after 15-minute warm-up
- Static alignment (head) centered to outer cylinder to ± 0.010 inch, parallel to outer cylinder to ≤ 1 mrad
- Polarization ("P" models only) Linear, $\geq 500:1$ extinction ratio

COMMON ENVIRONMENTAL SPECIFICATIONS

	OPERATING	NON-OPERATING
Temperature	– 20 °C to 50 °C	– 40 °C to 80 °C
Altitude	0–10,000 ft	0–70,000 ft
Relative humidity without condensation	0–100%	0–100%
Shock		15 g for 11 ms



10.0 mW MODELS WITH HIGH VOLTAGE CONNECTOR AND BEAM SHUTTER

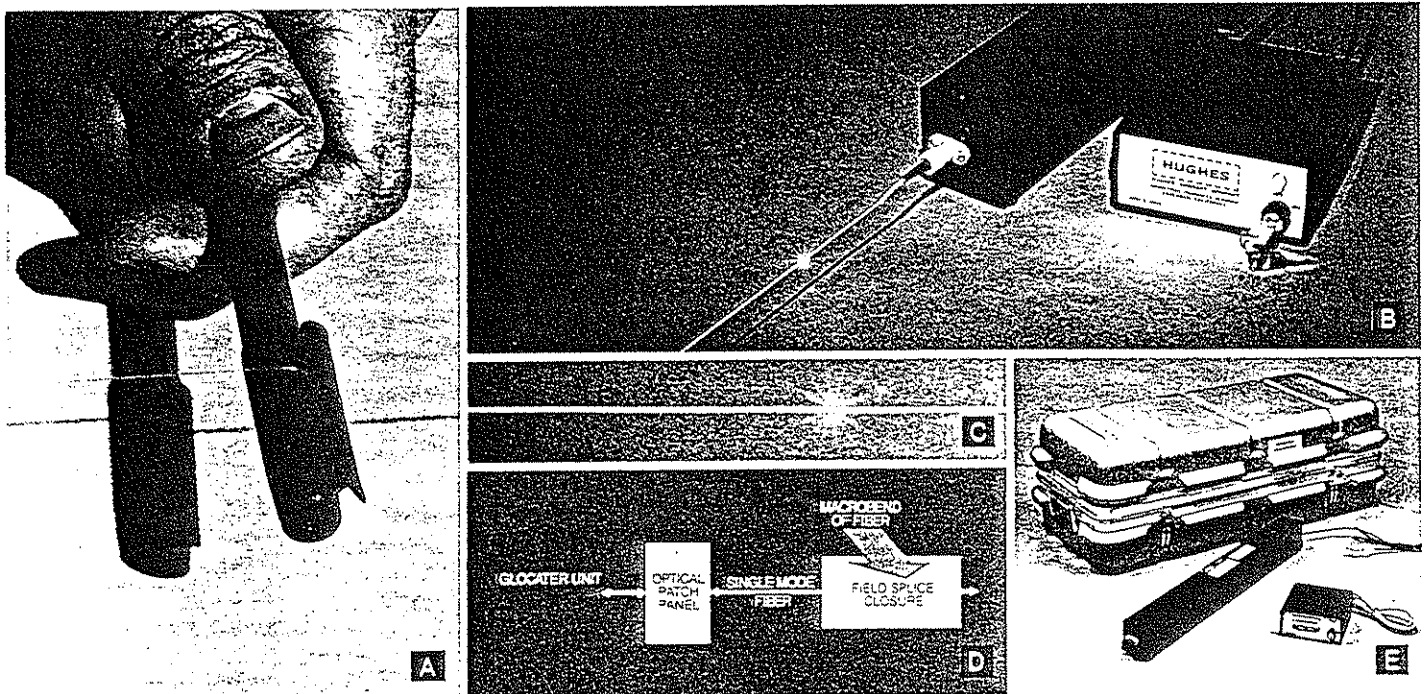
-  RECOMMENDED MOUNTING AREAS
 ALTERNATE MOUNTING AREA

Specifications are subject to change without notice

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6155 El Camino Real, Carlsbad, CA 92009 Tel: (619) 931-3587 TWX: 910-322-1393

Glocater™ Fiberoptic Fault Locator

MELLES GRIOT



Easily induced macrobend (12 mm is ideal) produces visible glow (A). Breaks show clearly (B) and (C). Connects directly to patch panel (D). Comes complete with carrying case (E).

A totally new concept for spotting fiberoptic faults instantly

Now, you can visually inspect optical fiber continuity during installation, maintenance and other procedures. This new fiberoptic fault locator identifies fibers, fiber breaks or imperfections using visible laser light.

The unique tool—consisting of a helium-neon laser, power supply and high efficiency fiber coupler—is simple to use. Just attach the unit to fibers under test, and the coherent red light emitted from the laser produces a bright orange glow at fault locations or bends. The glow is so intense that it is easily seen at breaks or imperfections through the outer coatings of fiber jumpers, pigtails or buffer tubes.

For fiber identification, the laser's visible red light appears in continuous fiber after inducing a constant macrobend. Existing fiber breaks and macrobends will produce a glow even without handling the fiber.

The Glocater fault locator is designed for use in the installation, rearrangement and maintenance of fiberoptic cables as well as in system acceptance testing of cables, jumpers and pigtails. It can also serve as an excellent tool for fiberoptic training centers. It can be used on single mode or multimode fiber of any wavelength—for example, 850, 1300 or 1550 nanometers—to verify continuity and positive end-to-end identification.

TYPICAL APPLICATIONS

Locating breaks. Connect the Glocater fault locator at the interconnect cabinet. Breaks in the pigtails, jumpers or coated fiber will emit an orange glow that is visible directly through the outer coating or buffer tubes anywhere within the cabinet.

Identifying fibers. Attach the fault locator to a fiber end. Bend the fiber over a finger or marking pen at any point along the fiber route. The orange glow appears at the bend to positively identify the fiber.

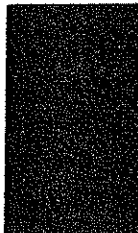
Locating points of attenuation. Connect the fault locator to a fiber end. At violated fiber bends, the glow can be seen through the jacketing on pigtails, jumpers or stored fiber.

The Glocater fiberoptic fault locator is compact, lightweight and comes complete with carrying case. It's an easy, affordable way to track down fiberoptic problems. Call or write today for full information or to request a demonstration.

NEW! Now available with FC connector

- RELIABLE • He-Ne laser for stable performance
- ECONOMICAL • Advanced fault detection at an affordable price
- EASY TO OPERATE • Simple connections are all that's needed
- SAFE TO USE • Built-in interlock for safe operation
- COMPACT • Carrying case holds complete unit

GLOCATER FIBEROPTIC FAULT LOCATOR SPECIFICATIONS

Transmitter		
Wavelength	632.8 nm	
Output level	+5 dBm or more (10/125 μ m single mode)	
Visible range*, nominal		
Single mode, one way	3.0 miles or more at -32 dBm	
Multi mode, one way	2.5 miles or more at -50 dBm	
Power requirements	115/220 Vac 50/60 Hz	
Connectors	Choice of biconic or fiber connector (FC); specify Adaptable to other connectors (consult factory)	
Dimensions (HxWxL)		
Transmitter	2.6x2.5x24.5 in (67x64x622 mm)	
Power supply	2.4x5.1x5.3 in (60x129x133 mm)	
Weight		
Transmitter	4.4 lb (2.0 kg)	
Power supply	2.3 lb (1.1 kg)	
Accessories supplied	Power supply equipped with safety interlock and power cord Carrying case	

*Visible red light observed after inducing a constant macrobend of 12 mm in diameter.

Specifications subject to change without notice.

Customer service assistance in evaluating proposed applications is available.

MELLES GRIOT

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